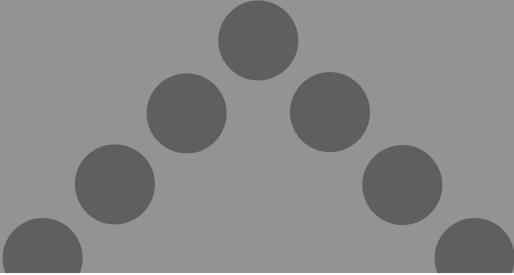




Electric / Gas / Water

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Advanced Metering and Demand Response Technology Overview

Montana PUC Meeting

February 22, 2006

Helena, Montana





Who We Are

- Itron provides turn key solutions to utilities around the world to optimize the delivery and use of energy and water
- Meter Data Acquisition & Management are the key to this process
- Itron's solutions' portfolio include "cradle to grave" AMR solutions, demand response solutions, enterprise-wide meter data management, distribution asset management tools & load research and forecasting solutions and AMR hardware, software and meters
- **Over 40 Million** AMR endpoints successfully deployed
- **Demand Response** solutions utilized in California, New York, Washington, and Iowa and Wisconsin
- **Over 2800** utility customers world wide
- Itron equipment & systems touch over **\$200 Billion** worth of energy and water transactions

Metering Status Quo

- Metering has remained basically unchanged since the Public Utility Holding Act was passed in 1935





EPACT 2005

■ The Energy policy of 2005 has put AMR, Smart Metering and Demand Response on the front burner.

- > There is a recipe for success here
- > Utilities working with the State PUC's have an opportunity to move their metering systems forward
- > Advanced metering systems and the related technologies will drive the future energy decisions for customers as well as utilities

Opportunity Statement

“The energy and water industry as a whole has yet to discover the true value of a commodity that is abundantly available in its own back yard.”

Metering Data!

Current AMR Market Penetration

28%



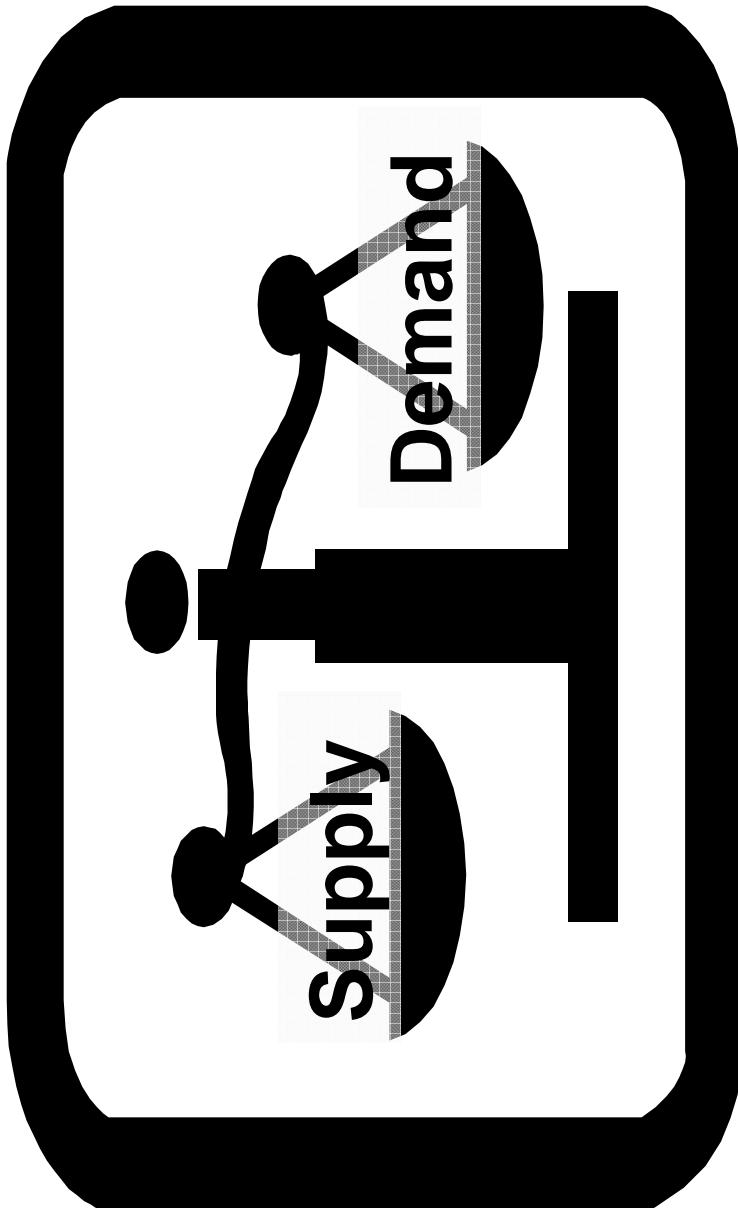
What is Automated Meter Reading?

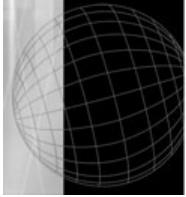
- Automated Meter Reading (AMR) is the deployment of communication technology in a non saturated or saturated environment to collect the meter reading – on a monthly, daily or real time basis.
- AMR helps solve the following issues
 - > No more customer or utility estimated reads & estimated bills
 - > Reliable, accurate monthly bills
 - > Improves customer service
 - > Provides significant operational savings

Why Is The Metering Data Needed?

To Balance Supply vs. Demand

SYSTEM RELIABILITY





Why Is The Metering Data Needed?

- As energy costs continue to rise consumers are paying more attention than ever before to how their energy dollars are spent.
- To allow consumers to make wise and informed decisions related to their energy purchases based on real and current data.



Who Needs This Metering Data ?

- Yesterday/Today:

- > Utilities

- Today/Tomorrow:

- > Utilities
 - > Energy Service Providers
 - > Marketers
 - > Meter Service Providers
 - > Consumers
- Future
 - > All of the above
 - > ISOs
 - > Regulators
 - > Others

Utilities
Marketers
Energy Service Providers
Regulators
ISOs
Consumers
Others
Meters
ISOs
Utilities
Regulators
ISOs
Consumers
Marketers
Energy Service Providers
Utilities



Customer Benefits

- “SYSTEM RELIABILITY”
- Accurate Timely Consumption Information
- Information To Allow For Educated Choice
- Facilitates Customer Choice
- Conservation Tool
- Improved Customer Service
- Reduced Emissions
- Conservation Incentives
- Increased Public Safety
- Dogs become less stressed



AMR Technologies Available Today

- Mobile AMR
- Wireless Network AMR
- Telephone-based AMR
- C&I Solutions - wireless and wired
- Energy Gateways
- PLC
- BPL
- Others...

It is unlikely that a single technology alone is the most cost effective way to reach all meters in an entire service territory

Off-site Meter Reading (OMR)

▪ Technology Description

- > Portable Radio installed in handheld computers
- > The handheld computer is plugged into the Meter reading software at the end of the day
- > The meter reading software processes the data for bill production
- > Average reader can read 600-800 meter reads/day

▪ Advantages

- > Eliminates the need to access the premise
 - > Automates the data collection with no manual entry hence eliminating the risk of data collection errors
- ## ▪ Where it is used
- > When high-cost or hazardous-to-reads are present
 - > Typically 5-10% of accounts requiring monthly reads
 - > Typically unsaturated – pockets scattered throughout the territory



Mobile Drive-by AMR (MAMR)

■ Technology Description

- > Data collection computer with a transceiver installed in utility vehicle
- > Collects Meter reading & messages while driving
- > Reads same radio module as OMR
- > Reads an average of 10,000 - 12,000 meters in an 8 hour shift

■ Functionality

- > Consumption reads
- > Tamper reporting

■ Input to Questions

- > Larger % of accounts - requiring monthly reads
- > Saturated areas or clustered saturation
- > Typically residential and small commercial



RF Fixed Network

- **Technology Description**

- > Meter modules installed on water, electric or gas meters
- > Communicates using public or private communication networks
- > Installed over small or large scale saturated areas
- > Reads meter modules via radio on configurable schedules

- **Same meter modules read by OMR or MAMR**

- **Functionality**

- > Daily reads
- > Advanced metering
- > Operational applications
 - Tamper reporting
 - Virtual disconnect
 - On-request reads
- > Network Monitoring





New Metering/Data Requirements

- More frequent reads/data to facilitate:
 - > SYSTEM RELIABILITY
 - > Demand Response
 - > Load Control
 - > Dynamic Pricing
 - > Real Time Pricing
 - > Load Balancing
 - > Load Forecasting
- > Oh Yeah: Customer Billing!!!



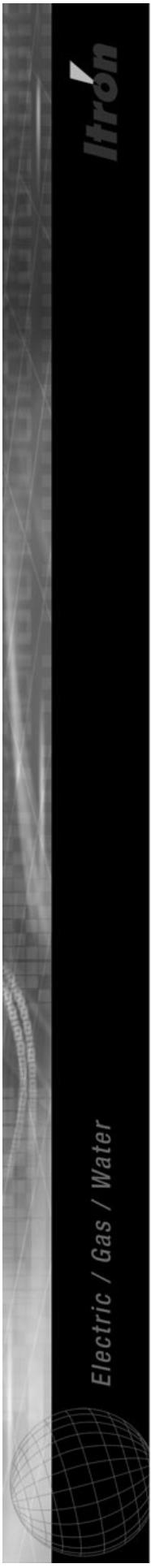
The Foundation For Migration

- Once the utility deploys Automated Meter Reading – it can then lead to Advanced Meter Data Collection without changing the meter thus “NO” stranded cost
- Advanced Meter Data Collection provides the following key functionality
 - > Innovative Rate Structure
 - > TOU, Critical Peak Pricing based tariffs
 - > Demand Response
 - > Residential energy Management
 - > On Demand Reads
 - > Smart Outage Detection and Restoration Detection
 - > Revenue Assurance (Tamper Detection and Stopped Meter Identification)
 - > Distribution Asset Optimization



AMR System Benefits

- SYSTEM RELIABILITY
- Load forecasting and balancing
- Demand-side management and incentives
- Load management and control
- Forecasting supply requirements
- Real time pricing
- Customer Choice
- Conservation
- Tamper Detection
- Damaged/Stopped Meters



Demand Response Solutions and Technologies

Types of Demand Response Solutions

Residential Demand Response

■ Home device control

- > Air conditioning switch – Utility automatically turns off or cycles A/C system
- > Smart Thermostat – Utility automatically sets back the thermostat or puts it in energy savings mode (duty cycle A/C system)
- > Pool pumps and hot water heaters – Utility automatically turns-off or controls these devices
- > Future: Smart home appliances that run the least when energy is most expensive. Utility may no longer need to initiate control. Price signals could be communicated to in-home device(s)
- > **Required Technologies:** Smart devices, communications, management software

■ Price responsive rates

- > Time of use rates
- > Critical peak pricing rates.
- > Real-time pricing

> **Required & Recommended Technologies:** Interval meter, meter data management software, communications/notification, web based tools for usage and cost presentation and analysis, enhanced billing software

■ Distributed generation, smart building design

- > Solar: Photovoltaics
- > Passive solar

Types of Demand Response Solutions (cont.)

Commercial & Industrial Demand Response – Most economical and best place to start

■ Customer takes action triggered by utility called events

- > Reliability based events
 - Customers must alter their energy demand based upon system reliability conditions
 - Customers receive discounted tariffs or capacity payments in return for call option to curtail
- > Price responsive events
 - Based up prices presented, customers decide to what extent to modify their demand
 - Customers are compensated for their performance relative to market prices
- > **Required & Recommended Technologies:** Interval meter, real-time or daily data collection, web based software to automate the notification, event response, monitoring and settlement processes for both utility and customer

Types of Demand Response Solutions (cont.)

Commercial & Industrial Demand Response – cont.

■ Price responsive rates

- > Time of use rates
- > Critical peak pricing programs
- > Real-time pricing

> **Required & Recommended Technologies:** Interval meter, real-time or daily data collection, meter data management software, communications/notification, web based tools for usage and cost presentation and analysis, enhanced billing software

■ Automated control based on price or utility triggered event

- > Customer's end use devices (lighting, heating and cooling, motors, other equipment) are automatically controlled based on a price signal)
- > **Required & Recommended Technologies:** Electronically communicate price signal, automated and optimized energy management system at customer facility (software & hardware)

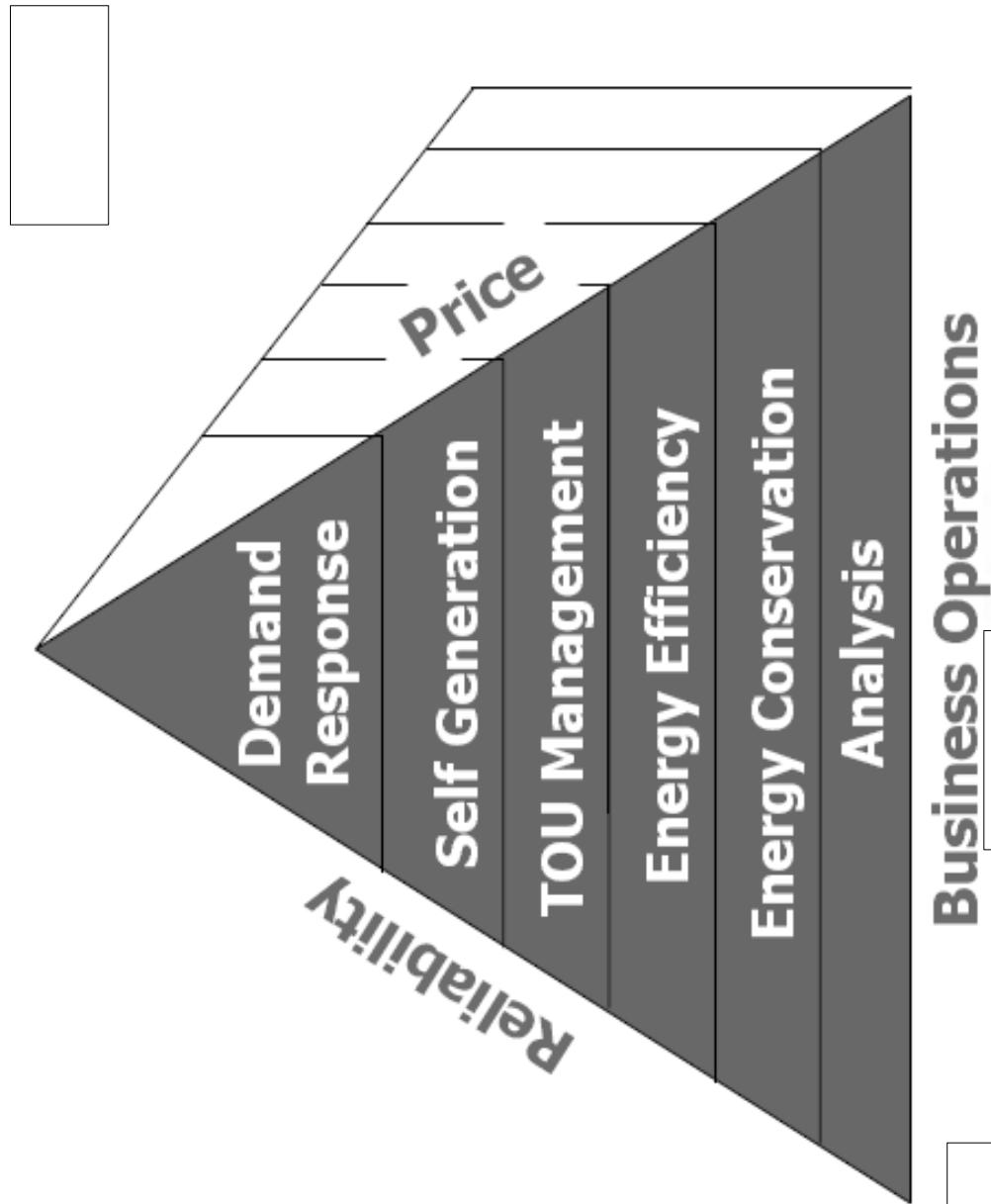
■ Distributed generation and end use demand mgmt and device efficiency



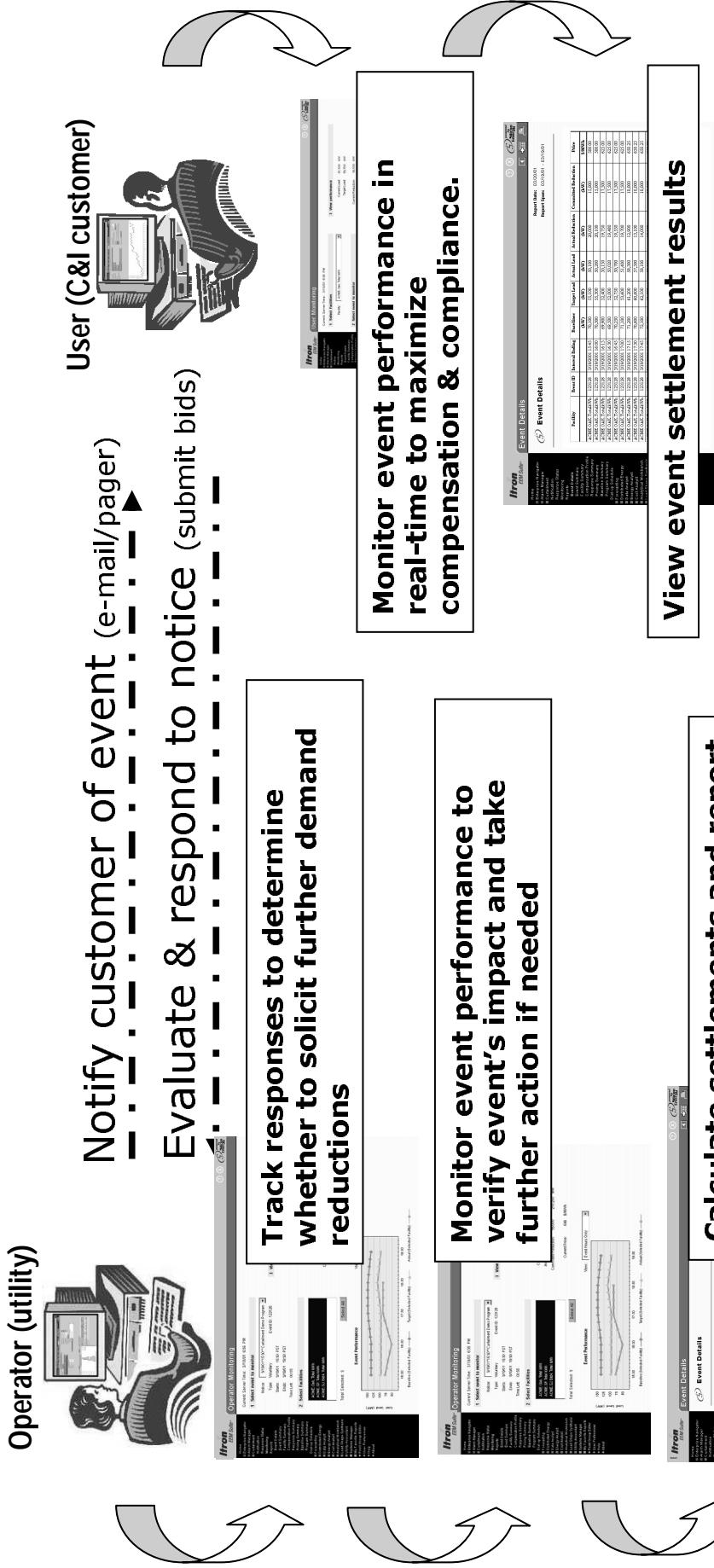
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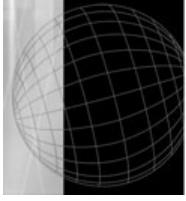
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Integrated Demand Side Management



Source: Sophia Mintun, Pacific Gas & Electric Co.

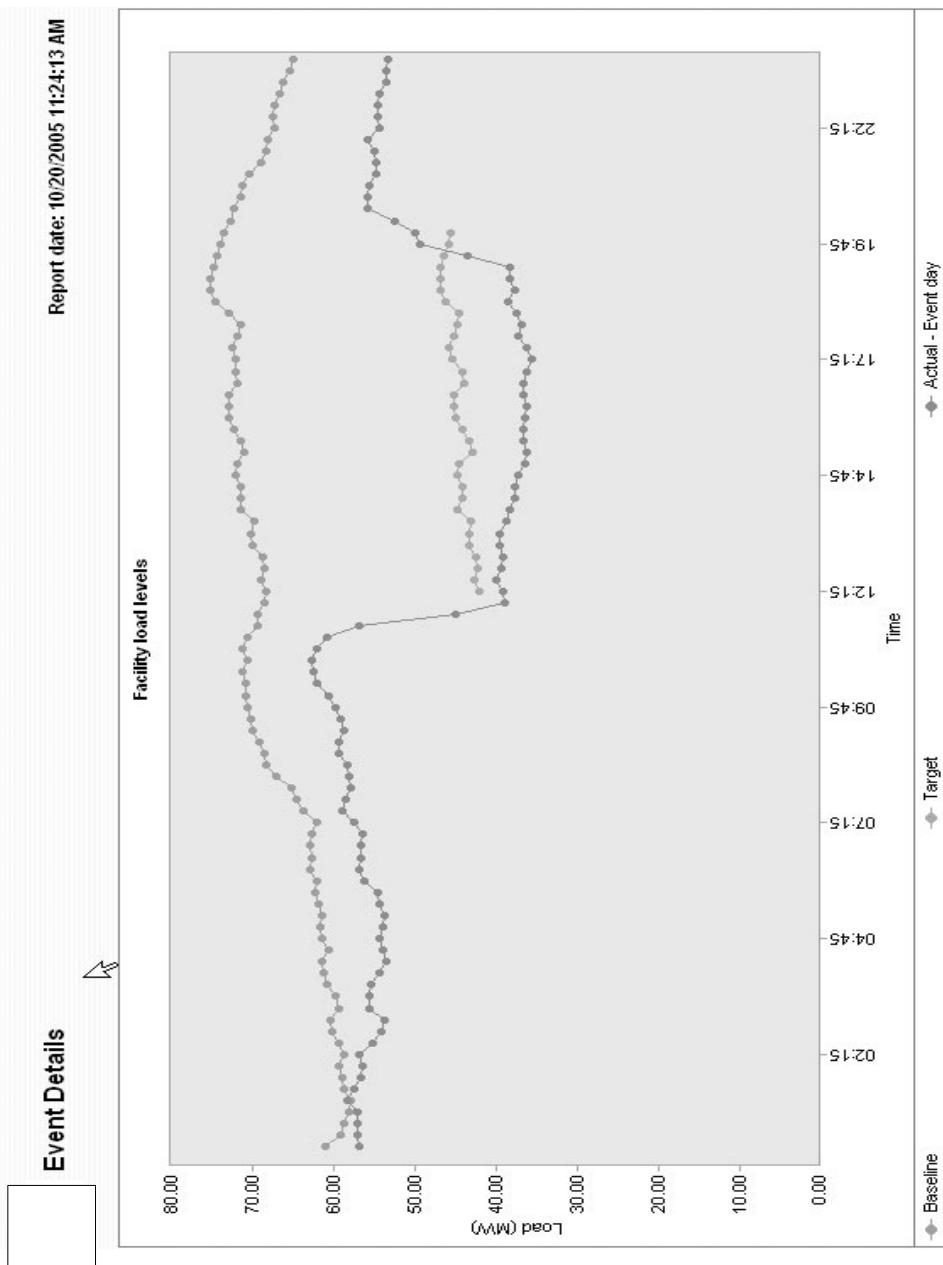




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Example CA Demand Bidding Results – July 29th, 2005



Summary

Notified Customers: 269
Accepted: 36
Percent Participation: 13%
Total Reduction (KWh): 260,428
Ave Demand Reduction from Baseline (MW): .32
Ave Est. Demand Reduction (MW): 20 – 27 MW
Ave Price: \$187/MWh
Price Range: \$158 – 207/MWh
Total Compensation: \$42,446



Example reliability based event

Utility reduced 100 MW over a six-hour period

50 customers monitored their results in real-time to maximize compliance

Operator Monitoring - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Operator Monitoring

Home

Curtailment

- Notification
- Response
- Status
- Monitoring
- Reports
- Event Details
- Event Sub Summary
- Correlation Profile
- Response Summary
- Baseline Summary
- Pricing Summary
- Program Summary
- Dial-Up Scheduler

1 Select event

Current server time : 8/18/2003 4:04 PM

151 == 8/18/2003 2:00 PM == Mandated Program 1

Event ID : 151 Type : Mandatory

Starts : 8/18/2003 2:00 PM CDT Ends : 8/18/2003 8:00 PM CDT

Time left : 0:57

2 Select facilities

VA Medical Center B633461 Meter

Veterans Hospital 10320 90014 Total

Warren Frozen Foods 3387170 Meter

WorldCom 23600 0320 Total

Total selected: 49

3 View performance

All running events

Selected facilities

Current load : 25,977 MW

Target load : 37,412 MW

Current reduction : 46,055 MW

Average reduction : 46,836 MW

Event Details

Event Details - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Event Details

Home

Curtailment

Notification

Status

Monitoring

Reports

My Favorite Reports

Point group editor

User preferences

Help

About

Logout

Facility load levels

Facility 10

Plot area

Report date: 8/27/2003 11:34:12 AM

Time

Actual - Event day

Baseline

Target

Load (MW)

150.00

120.00

90.00

60.00

30.00

0.00

14:30 15:00 16:00 16:30 17:00

Data Analyst

Energy Analyst

System Manager

My Favorite Reports

Point group editor

User preferences

Help

About

Logout

Chart area

Facility 10

Plot area

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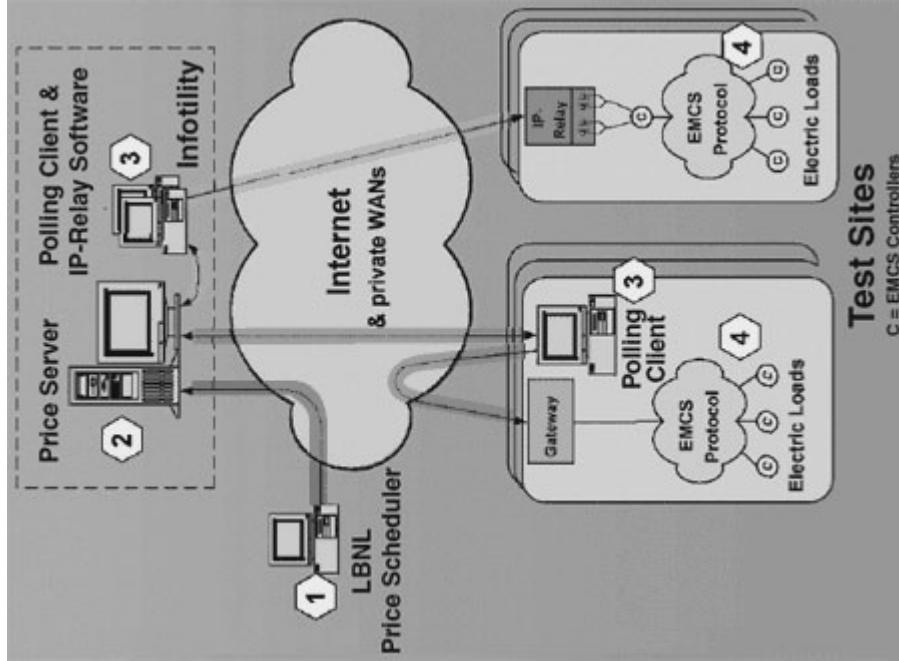
Logout



Automated C&I Critical Peak Pricing for Commercial Facilities

- Collaborative pilot project started in 2005
- Lead by Lawrence Berkeley Labs and funded by PIER
- Extension of LBL's Automated Facility Demand Response project started in 2003
- PG&E and 10 commercial facilities participated
- Objectives
 - > Demonstrate how an automated notification system for critical peak pricing can be used in large commercial facilities for demand response (DR). Evaluate effectiveness of such a system. Determine how customers will respond to this form of automation for CPP.
 - > Evaluate what type of DR shifting and shedding strategies can be automated.
 - > Develop information systems for commercial customers such as energy consumption feedback, audits, and economic analysis tools.
 - > Demonstrate integrated energy management using advanced controls for both energy efficiency and DR. (Sample candidate for such a demonstration is dimmable ballast.)
 - > Explore how automation of control strategies can increase participation rates and DR from CPP and automation.
 - > Evaluate CPP economics and the influence of various rate designs.
 - > Understand the costs and benefits of CPP from the owners' perspective.
 - > Identify optimal control and shedding strategies.
 - > Determine occupant and tenant response.

How Automated C&I Demand Response Works



1. PG&E defines and sends price schedule to price server one day ahead.
2. Price published on server.
3. Polling clients request price every few minutes.
4. Energy Management Control System carries out shed based on price.
5. Customers have option to opt out

Two possible communication technologies:
Software gateway
IP Relay

EMCS configured with three modes of operation:
Normal, medium, and high price



Conclusion

The question is not whether we can afford advanced metering and related technologies, but how long can be afford to without them and the opportunities they bring!!!



Contact Information

Emmett Kelly
Itron, Inc.

Vice President Regulatory Affairs
Office: 410-692-9109
Email: emmett.kelly@itron.com

Matt Owens
Itron, Inc.

Director, Product Line Mgmt
Office: 510-844-2845
Email: matt.owens@itron.com

Itron web-site: www.itron.com